

PREFACE

THE object of the present volume is: to indicate the character and, approximately, the extent of the changes produced by human action in the physical conditions of the globe we inhabit; to point out the dangers of imprudence and the necessity of caution in all operations which, on a large scale, interfere with the spontaneous arrangements of the organic or the inorganic world; to suggest the possibility and the importance of the restoration of disturbed harmonies and the material improvement of waste and exhausted regions; and, incidentally, to illustrate the doctrine, that man is, in both kind and degree, a power of a higher order than any of the other forms of animated life, which, like him, are nourished at the table of bounteous nature.

In the rudest stages of life, man depends upon spontaneous animal and vegetable growth for food and clothing, and his consumption of such products consequently diminishes the numerical abundance of the species which serve his uses. At more advanced periods, he protects and propagates certain esculent vegetables and certain fowls and quadrupeds, and, at the same time, wars upon rival organisms which prey upon these objects of his care or obstruct the increase of their numbers. Hence the action of man upon the organic world tends to subvert the original balance of its species, and while it reduces the numbers of some of them, or even extirpates them altogether, it multiplies other forms of animal and vegetable life.

The extension of agricultural and pastoral industry involves an enlargement of the sphere of man's domain, by encroachment upon the forests which once covered the greater part of the earth's surface otherwise adapted to his occupation. The felling of the woods has been attended with momentous consequences to the drainage of the soil, to the external configuration of its surface, and probably, also, to local climate; and the importance of human life as a transforming power is, perhaps, more clearly demonstrable in the influence man has thus exerted upon superficial geography than in any other result of his material effort.

Lands won from the woods must be both drained and irrigated;

river banks and maritime coasts must be secured by means of artificial bulwarks against inundation by inland and by ocean floods; and the needs of commerce require the improvement of natural, and the construction of artificial channels of navigation. Thus man is compelled to extend over the unstable waters the empire he had already founded upon the solid land.

The upheaval of the bed of seas and the movements of water and of wind expose vast deposits of sand, which occupy space required for the convenience of man, and often, by the drifting of their particles, overwhelm the fields of human industry with invasions as disastrous as the incursions of the ocean. On the other hand, on many coasts, sand hills both protect the shores from erosion by the waves and currents, and shelter valuable grounds from blasting sea winds. Man, therefore, must sometimes resist, sometimes promote, the formation and growth of dunes, and subject the barren and flying sands to the same obedience to his will to which he has reduced other forms of terrestrial surface.

Besides these old and comparatively familiar methods of material improvement, modern ambition aspires to yet grander achievements in the conquest of physical nature, and projects are meditated which quite eclipse the boldest enterprises hitherto undertaken for the modification of geographical surface.

The natural character of the various fields where human industry has effected revolutions so important, and where the multiplying population and the impoverished resources of the globe demand new triumphs of mind over matter, suggests a corresponding division of the general subject, and I have formed the distribution of the several topics to the chronological succession in which man must be supposed to have extended his sway over the different provinces of his material kingdom. I have, then, in the Introductory chapter, stated, in a comprehensive way, the general effects and the prospective consequences of human action upon the earth's surface and the life which peoples it. This chapter is followed by four others in which I have traced the history of man's industry as exerted upon Animal and Vegetable Life, upon the Woods, upon the Waters, and upon the Sands; and to these I have added a concluding chapter upon Probable and Possible Geographical Revolutions yet to be effected by the art of man.

I have only to add what, indeed, sufficiently appears upon every page of the volume, that I address myself not to professed

physicists, but to the general intelligence of educated, observing, and thinking men; and that my purpose is rather to make practical suggestions than to indulge in theoretical speculations properly suited to a different class from that to which those for whom I write belong.

GEORGE P. MARSH.

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